Amendment to the Claims

1. (Original) A device for forming an array of magnetic particles, the device comprising:
a substrate comprising a plurality of magnetic regions, wherein the magnetic regions produce a plurality of localized magnetic fields when magnetized, and wherein the localized magnetic fields are sufficient to trap a magnetic particle with a trapping energy at least five times greater than the thermal energy of the particle at room temperature.

2. (Currently amended) The device of claim 1 ~~0~~, wherein the localized magnetic fields are sufficient to trap a magnetic particle with a trapping energy at least an order of magnitude greater than the thermal energy of the particle at room temperature.

3. (Currently amended) The device of claim 1 ~~0~~, wherein the localized magnetic fields are sufficient to trap a magnetic particle with a trapping energy at least three times greater than the thermal energy of the particle at room temperature.

4. (Currently amended) The device of any of claims 1 ~~0~~, 2, or 3, wherein the thermal energy of the particle is approximately 0.025 eV.

5. (Currently amended) The device of any of claims 1 ~~0~~, 2, or 3, wherein the localized magnetic fields exist substantially in a volume between adjacent magnetic regions.

6. (Currently amended) The device of any of claims 1 ~~0~~, 2, or 3, wherein each of the localized magnetic fields corresponds to a different single magnetic region and exists substantially in a volume between opposite poles of that magnetic region.

7. (Currently amended) The device of any of claims 1 ~~0~~, to 4, wherein the magnetic regions project above the surface of the substrate.

8. (Original) The device of claim 7 wherein the magnetic regions have walls that are substantially perpendicular to the substrate.

9. (Original) The device of claim 7, wherein the magnetic regions comprise a layer of magnetic material and a layer of nonmagnetic material, wherein the layer of nonmagnetic material is located between the substrate and the layer of magnetic material.

10. (Currently amended) The device of claim 1 ~~0~~, wherein the magnetic material regions are arranged in a pattern of mutually perpendicular rows and columns.

11. (Currently amended) The device of claim 1 ~~0~~, wherein the magnetic regions are arranged in an array of subarrays configuration.

12. (Currently amended) The device of claim 1 ~~0~~, wherein the magnetic regions are substantially uniform in shape.

13. (Currently amended) The device of claim 1 ~~0~~, wherein the magnetic regions are substantially rectangular in shape.

14. (Currently amended) The device of claim 1 ~~0~~, wherein the magnetic regions have a circular cross-section.

15. (Currently amended) The device of claim 1 ~~0~~, wherein the magnetic regions are substantially uniform in size.

16. (Currently amended) The device of claim 1 ~~0~~, wherein the number of magnetic regions is at least 1000 per centimeter squared.

17. (Currently amended) The device of claim 1 ~~0~~, wherein the number of magnetic regions is at least 10,000 per centimeter squared.

18. (Currently amended) The device of claim 1 ~~0~~, wherein the number of magnetic regions is at least 100,000 per centimeter squared.

19. (Currently amended) The device of claim 1 ~~0~~, wherein the number of magnetic regions is at least 250,000 per centimeter squared.

20. (Currently amended)The device of claim 1 ~~0~~, wherein the number of magnetic regions is at least 1,000,000 per centimeter squared.

21. (Currently amended) The device of claim 1 ~~0~~, wherein adjacent magnetic regions are separated by a gap approximately equal in size to the size of a magnetic particle.

22. (Original) The device of claim 21, wherein the magnetic particle has a greatest dimension selected from the group consisting of: 30 nm, 100 nm, 300 nm, 500 nm, 1 mm, 3 mm, 5 mm, and 10 mm.

23. (Original) The device of claim 22 wherein the magnetic particle is substantially spherical, and the greatest dimension of the particle is the diameter of the particle.

24. (Currently amended) The device of claim 1 ~~0~~, wherein adjacent magnetic regions are separated by a gap having a greatest dimension approximately equal in size to the greatest dimension of a magnetic particle.

25. (Original) The device of claim 24, wherein the gap has a greatest dimension approximately equal in size to the greatest dimension of a magnetic particle having a greatest dimension

selected from the group consisting of: 30 nm, 100 nm, 300 nm, 500 nm, 1 mm, 3 mm, 5 mm, and 10 mm.

26. (Original) The device of claim 25, wherein the magnetic particle is substantially spherical, and the greatest dimension of the particle is the diameter of the particle.

27. (Original) The device of claim 21, wherein the gap has a minimum length of approximately 1 micron.

28. (Original) The device of claim 21, wherein the gap has a minimum length of approximately 3 microns.

29. (Original) The device of claim 21, wherein the gap has a minimum length of approximately 5 microns.

30. (Currently amended) The device of claim 1 ~~0~~, wherein the magnetic regions comprise a magnetic material.

31. (Original) The device of claim 30, wherein the magnetic material is a ferromagnetic material.

32. (Currently amended) The device of claim 1 ~~0~~, wherein the substrate comprises a nonmagnetic material.

33. (Currently amended) The device of claim 1 ~~0~~, wherein at least a portion of the device comprises a biocompatible material.

34. (Currently amended) The device of claim 1 ~~0~~, wherein at least the surface of the substrate and the magnetic regions comprises a biocompatible material.

35. (Original) The device of claim 32, wherein the magnetic regions are surrounded by nonmagnetic material.

36. (Original) The device of claim 32, wherein the substrate comprises silicon.

37. (Currently amended) The device of claim 1 ~~0~~, wherein the magnetic regions comprise cobalt.

38. (Currently amended) The device of claim 1 ~~0~~, wherein the magnetic regions are formed using photolithography.

39. (Currently amended) The device of claim 1 ~~0~~, wherein the magnetic particles are magnetic beads.

40. (Currently amended) The device of claim 1 ~~0~~, wherein the magnetic particles are paramagnetic particles.

41. (Currently amended) The device of claim 1 ~~0~~, wherein the magnetic particles are superparamagnetic particles.

42. (Currently amended) The device of claim 1 ~~0~~, further comprising a flux circulator.

43. (Currently amended) The device of claim 1 ~~0~~, further comprising a plurality of photodetectors.

44. (Currently amended) The device of claim 1 ~~0~~, further comprising a microfluidic assembly.

45. (Currently amended) The device of claim 1 ~~0~~, further comprising a plurality of magnetic particles.

46. (Original) The device of claim 45, wherein the magnetic particles are substantially uniform in size and shape and are magnetic beads.

47. (Original) The device of claim 45, wherein the magnetic particles are substantially uniform in size and shape and are paramagnetic beads.

48. (Original) The device of claim 45, wherein the magnetic particles are substantially uniform in size and shape and are superparamagnetic beads.

49. (Original) The device of claim 45, wherein the magnetic particles are trapped by the localized magnetic fields.

50. (Original) The device of claim 45, wherein each of a plurality of the magnetic particles comprises a detectable moiety.

51. (Original) The device of claim 50, wherein the detectable moiety comprises a fluorescent or luminescent molecule.

52. (Original) The device of claim 50, wherein the detectable moiety comprises a nucleic acid.

53. (Original) The device of claim 52, wherein the nucleic acid comprises a hybridization tag.

54. (Original) The device of claim 45, wherein each of a plurality of the magnetic particles has a probe attached thereto.

55. (Original) The device of claim 54, wherein the probe comprises a binding ligand.

56. (Original) The device of claim 54, wherein the probe comprises a nucleic acid molecule.

57. (Original) The device of claim 54, wherein the probe comprises a protein.

58. (Currently amended) The device of claim 1 ~~0~~, further comprising a magnet for magnetizing and demagnetizing the magnetic regions.

59. (Original) A device for forming an array of magnetic particles, the device comprising:
a substrate comprising a plurality of magnetic regions, wherein the localized magnetic regions produce a plurality of localized magnetic fields, and wherein the magnetic regions project above the surface of the substrate.

60. (Currently amended) The device of claim 59 ~~0~~, further comprising a plurality of magnetic particles.

61. (Currently amended) The device of claim 59 ~~0~~, wherein the magnetic regions are substantially uniform in size and shape.

62. (Currently amended) The device of claim 59 ~~0~~, wherein the magnetic regions are arranged in a pattern of mutually perpendicular rows and columns.

63. (Original) A device for forming an array of magnetic particles, the device comprising:
a nonmagnetic substrate; and

a plurality of magnetic regions located on the substrate, wherein a localized magnetic field exists between adjacent magnetic material regions when magnetized.

64. (Currently amended) The device of claim 59 ~~θ~~, further comprising a plurality of magnetic particles.

65. (Currently amended) The device of claim 59 ~~θ~~,wherein the magnetic regions are substantially uniform in size and shape.

66. (Currently amended) The device of claim 59 ~~θ~~,wherein the magnetic regions are arranged in a pattern of mutually perpendicular rows and columns.

67. (Currently amended) The device of claim 59 ~~θ~~, wherein the magnetic regions project above the surface of the substrate.

68. (Original) A device for forming an array of magnetic particles, the device comprising:

a substrate comprising a plurality of magnetic regions, wherein the magnetic regions produce a plurality of localized magnetic fields when magnetized, and wherein the localized magnetic fields generate forces sufficient to trap a magnetic particle with a trapping energy at least five times greater than the thermal energy of the particle at room temperature.

69. (Original) A randomly ordered array of magnetic particles.

70. (Currently amended) The array of claim 60 ~~θ~~, wherein the magnetic particles are trapped by localized magnetic fields.

71. (Currently amended) The array of claim 60 ~~θ~~ or claim 70, wherein the magnetic particles are beads.

72. (Original) The array of claim 71, wherein each of a plurality of the magnetic particles comprises a probe.

73. (Original) The array of claim 71, wherein the beads are encoded.

74. (Currently amended) A method of forming an array of magnetic particles comprising: contacting the device of any of claims 69 ~~0~~, 70 ~~0~~, or 71 ~~0~~ with a plurality of magnetic particles.

75. (Currently amended) The method of claim 74 ~~0~~, wherein the plurality of magnetic particles comprises at least two populations of magnetic particles, wherein the populations are distinguishable.

76. (Currently amended) The method of claim 74 ~~0~~, wherein the step of contacting comprises dispensing the magnetic particles in a fluid medium.

77. (Currently amended) The method of claim 74 ~~0~~, further comprising the steps of:
removing a majority of the magnetic particles from the device; and
reusing the device in a subsequent analytical process.

78. (Currently amended) An array formed according to the method of claim 74 ~~0~~.

79. (Original) A method of forming an array of magnetic particles comprising steps of: contacting magnetic particles with a device comprising magnetic regions that produce localized magnetic fields, whereby a plurality of the magnetic particles are trapped by the localized magnetic fields.

80. (Currently amended) The method of claim 79 ~~0~~, wherein the step of contacting comprises dispensing the magnetic particles in a fluid medium.

81. (Currently amended) The method of claim 79 ~~0~~, wherein the magnetic particles comprise at least two populations of magnetic particles, wherein the populations are distinguishable.

82. (Currently amended) The method of claim 79 ~~0~~, further comprising the steps of:
removing a majority of the magnetic particles from the device; and
reusing the device in a subsequent analytical process.

83. (Currently amended) An array of magnetic particles formed according to the method of claim 79 ~~0~~.

84. (Currently amended) The array of claim 83 ~~0~~, wherein each of a plurality of the magnetic particles comprises a probe.

85. (Currently amended) The array of claim 83 ~~0~~, wherein the magnetic particles comprise at least two populations of magnetic particles, wherein the populations are distinguishable.

86. (Original) A method of analyzing a sample comprising:

contacting the sample with magnetic particles, wherein each of a plurality of the magnetic particles comprises a probe;

forming an array of the magnetic particles; and

determining whether a probe interacts with a target in the sample.

87. (Currently amended) The method of claim 86 ~~0~~, wherein the determining step comprises performing an assay selected from the group consisting of: a genotyping assay, a hybridization assay, an SBE assay, an OLA assay, an ASPE assay, an allelic PCR assay, an exonuclease assay, and an invasive cleavage assay.

88. (Original) The method of claim 87, wherein the plurality of magnetic particles comprises at least two populations of magnetic particles, with each population comprising a unique probe selected from a set of universal hybridization tags.

89. (Original) The method of claim 88, wherein the sample contains targets, and wherein the targets in the sample contain sequences complementary to the universal hybridization tags, and wherein generation of the targets involves reformatting any arbitrary nucleic acid sequence to be detected to a unique sequence chosen from the set of universal tags.

90. (Currently amended) The method of claim 86 ~~θ~~, wherein the determining step comprises performing an enzyme-linked immunosorbent (ELISA) assay.

91. (Currently amended) The method of claim 86 ~~θ~~, wherein the contacting step occurs before the forming step.

92. (Currently amended) The method of claim 86 ~~θ~~, wherein the forming step occurs before the contacting step.

93. (Currently amended) The method of claim 86 ~~θ~~, wherein the plurality of magnetic particles comprises at least two populations of magnetic particles, wherein each of the populations of magnetic particles comprises a different probe.

94. (Currently amended) The method of claim 86 ~~θ~~, wherein the plurality of magnetic particles comprises at least two populations of magnetic particles, wherein the populations are distinguishable.

95. (Original) The method of claim 94, wherein each population of beads is labeled with a detectable moiety, wherein the detectable moieties differ in amount or in chemical structure between different populations of magnetic particles.

96. (Original) The method of claim 95, wherein the detectable moiety is a fluorescent or luminescent molecule or a hybridization tag.

97. (Currently amended) The method of claim 86 ~~θ~~, wherein the step of determining comprises: determining whether a probe binds to a target.

98. (Currently amended) The method of claim 86 ~~θ~~, wherein a target interacts with a probe, and wherein the determining step comprises:
determining the identity of the probe.

99. (Currently amended) The method of claim 86 ~~θ~~, wherein a target interacts with a probe, and wherein the determining step comprises:

determining the identity of the target.

100. (Currently amended) The method of any of claims 86 ~~θ~~, 97, 98, or 99, wherein the probe and the target comprise nucleic acid molecules.

101. (Currently amended) The method of any of claims 86 ~~θ~~, 97, 98, or 99, wherein the determining step comprises detection using a confocal scanner or a charge coupled device.

102. (Original) A method of analyzing a sample comprising:

contacting the sample with magnetic particles, wherein each of a plurality of the magnetic particles comprises a probe;

forming an array of the magnetic particles; and

performing an assay selected from the group consisting of: a genotyping assay, a hybridization assay, an SBE assay, an OLA assay, an ASPE assay, an allelic PCR assay, an exonuclease assay, and an invasive cleavage assay, and an enzyme-linked immunosorbent (ELISA) assay.

103. (Original) The method of claim 102, wherein the contacting step occurs before the forming step.

104. (Original) The method of claim 102, wherein the forming step occurs before the contacting step.

105. (Original) The method of claim 102, wherein the magnetic particles comprise at least two populations of magnetic particles, wherein the populations are distinguishable.

106. (Original) The method of claim 102, wherein the magnetic particles comprise at least two populations of magnetic particles, wherein each of the populations comprises a probe.

107. (Original) The method of claim 102, wherein the plurality of magnetic particles comprises at least two populations of magnetic particles, with each population comprising a unique probe selected from a set of universal hybridization tags.

108. (Original) The method of claim 102, wherein the sample contains targets, and wherein the targets in the sample contain sequences complementary to the universal hybridization tags, and wherein generation of the targets involves reformatting any arbitrary nucleic acid sequence to be detected to a unique sequence chosen from the set of universal tags.

109. (Original) A method of analyzing a sample comprising:

contacting the sample with magnetic particles, wherein each of a plurality of the magnetic particles comprises a probe;

forming an array of the magnetic particles; and

performing an enzyme-linked immunosorbent (ELISA) assay.

110. (Original) A method of fabricating a device comprising steps of:

providing a substrate;

producing magnetic regions in or on the substrate, wherein the magnetic regions produce a plurality of magnetic fields when magnetized, and wherein the localized magnetic fields are sufficient to trap a magnetic particle with a trapping energy at least five times greater than the thermal energy of the particle at room temperature.

111. (Original) A method of fabricating a device comprising:

providing a substrate;

producing magnetic regions in or on the substrate, wherein the magnetic regions produce a plurality of localized magnetic fields, and wherein the magnetic regions project above the surface of the substrate.

112. (Original) The method of claim 111, wherein the magnetic regions comprise a magnetic material, and wherein the magnetic regions are fabricated using photolithography.

Conclusion

In light of the foregoing Amendment, Applicants respectfully submit that the present case is in condition for allowance. A Notice to that effect is respectfully requested.

If, at any time, it appears that a phone discussion would be helpful or if questions arise regarding the amendment proposed above, please do not hesitate to contact the undersigned at (617) 248-5071.

Please charge any fees that may be required, or credit any overpayments, to our Deposit Account No. 03-1721.

Respectfully submitted,

Monica R. Gerber

Monica R. Gerber, M.D., Ph.D.
Registration Number 46,724

Dated: October 22, 2003
PATENT GROUP
CHOATE, HALL & STEWART
Exchange Place
53 State Street
Boston, MA 02109
Tel: (617) 248-5000
Fax: (617) 248-4000